



Research Paper

Socio-economic conditions of Bt cotton growers across different farm size holders in northern transitional zone of Karnataka

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Paper History :

Received : 30.12.2015;

Revised : 01.08.2016;

Accepted : 24.08.2016

ABSTRACT : Karnataka is one of the nine major Bt cotton-growing states in the country. Northern transitional zone is the major cotton growing zone of Karnataka *i.e.* 40.19 per cent of the total cotton area of Karnataka. It focused on the socio-economic characteristics of Bt cotton farmers and the economics of Bt cotton production under different farm sizes. Two taluks having highest cotton area were selected from the zone for study. The study was conducted with primary data collected entirely based on a multi stage sampling technique from 180 Bt cotton growing farmers. The study pertained to the agricultural year 2011. The total variable cost of Bt cotton was Rs. 22192.15 where, large farmers incurred high cost *i.e.* Rs. 23256.85. The total cost of Bt cotton was Rs. 30920.56 and it was high in large farmers Rs. 32723.90. The net return in Bt cotton was Rs. 79456.36 and net returns were seen high in case of large farmers Rs. 84677.90. The yield per ha was 24.98 qtls and medium farmers got high yields *i.e.* 25.54 qtls. Bt cotton technology has positive impact on socio- economic status of farmers by increase in yield and reducing cost on inputs thereby increase in income and also standard of living.

KEY WORDS: Bt cotton, Yield, Small farmer, Medium farmer, Large farmer

HOW TO CITE THIS PAPER : Gamanagatti, P.B. and Dodamani, M. T. (2016). Socio-economic conditions of Bt cotton growers across different farm size holders in northern transitional zone of Karnataka. *Internat. Res. J. Agric. Eco. & Stat.*, 7 (2) : 223-227, DOI : 10.15740/HAS/IRJAES/7.2/223-227.

INTRODUCTION :

Concerns and controversies notwithstanding, India embarked upon commercial deployment of genetically modified crops in form of Bt (*Bacillus thuringiensis*) cotton in 2002. Amongst all the pests which attack cotton in India, bollworms namely, American bollworm (*Helicoverpa armigera*), spotted bollworm (*Earias insulana* and *Earias vitella*) and pink bollworm (*Pectinophora gossypiella*) cause major damage. Nearly 54 per cent of the total pesticides are used for

the control of pests in cotton alone, out of which about 60 per cent are used for the control of bollworms. Indiscriminate use of pesticides has adversely affected pest control and profit to the farmers. Under these circumstances, Bt cotton has emerged as an attractive option for the cotton farmers (Singh and Kaushik, 2007).

Cotton occupies a predominant place among cash crops touching the country's economy at several points by generating direct and indirect employment in the agricultural and industrial sectors. Cotton occupies a place of pride being the prime supplier of raw material (85 %) for textile industry, which is one of the leading industries

in the country. Cotton industries provide means of livelihood for about 250 million people through its cultivation, trade and industries in India. Commercially cotton is one of the best export earning commodities in the country. Textiles and related exports of which cotton constitutes nearly 65 per cent, accounts for nearly 33 per cent of the total foreign exchange earnings of our country (Choudary and Gaur, 2010).

Bt cotton, which confers resistance to important insect pests of cotton, was first adopted in India as hybrids in 2002. There were 54,000 farmers who grew approximately 50,000 hectares of officially approved Bt cotton hybrids for the first time in 2002 which doubled to approximately 100,000 hectares in 2003. The Bt cotton area increased again four-fold in 2004 to reach half a million hectares. In 2005, the area planted to Bt cotton in India continued to climb reaching 1.3 million hectares, an increase of 160 per cent over 2004. In 2006, the adoption record increased which continued with almost a tripling of the area of Bt. cotton to 3.8 million hectares. This tripling in area was the highest percentage year-on-year growth for any country planting biotech crops in the world in 2006. Notably in 2006, India's Bt cotton area (3.8 million hectares) exceeded for the first time, that of China's 3.5 million hectares. In 2007, the Indian cotton sector continued to grow with a record increase of 63 per cent in Bt cotton area from 3.8 to 6.2 million hectares, to become the largest hectare of Bt cotton in any country in the world. In 2008, the Bt cotton area increased yet again to a record 7.6 million hectares from 6.2 million hectares in 2007. Maintaining double digit growth, the Bt cotton area increased to 8.4 million hectares in 2009, over 7.6 million hectares in the previous year. Despite a very high level of adoption in 2008, 2009 was the fifth consecutive year for India to have the largest year-on-year percentage growth of all biotech cotton growing countries in the world; a 160 per cent increase in 2005, followed by a 192 per cent increase in 2006, a 63 per cent increase in 2007, 23 per cent increase in 2008 and a 11 per cent increase in 2009.

Thus, within a span of eight years, nearly 87 per cent of the cotton area in India came under Bt hybrid umbrella. It is envisaged that with availability of more Bt hybrids coupled with reduction in seed cost from 2006 onwards, the area under Bt cotton is likely to show a perceptible increase in future too. Among the cotton growing states Maharashtra leads the others with 3.4 m ha under Bt cotton followed by Andhra Pradesh and

Gujarat with 1.05 and 1.68 m ha, respectively. Thus, it can be seen that the cultivation of Bt cotton hybrids has picked up momentum in the last four years and it is being cultivated in all the three cotton growing zones of the country.

In India the first two-gene commonly known as Bollgard II (BGII) was developed by Mahyco and sourced from Monsanto, featured the two genes *cry1Ac* and *cry2Ab*, and was approved for sale for the first time in 2006. In 2009, the multiple gene Bt cotton hybrids were planted for the first time on more area (57%) than single gene Bt cotton hybrids occupying 4.82 million hectares as compared to 3.58 million (43%) occupied by single gene Bt cotton hybrids. It is projected that the multiple gene Bt cotton hybrids will occupy approximately 90 per cent of total Bt cotton area in 2010.

MATERIALS AND METHODS :

The multi stage sampling technique was adopted for the collection of primary data from sample farmers. Bt cotton is grown extensively in Northern transitional zone of Karnataka *i.e.* 40.41 per cent of the total area under north Karnataka, hence, this zone was purposively selected for the study. The zone contains fourteen taluks. From the zone two taluks were selected based on the highest Bt cotton cultivation. Therefore, in the first stage these top two taluks in cotton area were selected. Based on the information provided by the office of the Assistant Director of agriculture from each taluks, five villages having highest area under cotton were selected in the second stage. Finally six small farmers, six medium farmers, six large farmers were selected from each village randomly. Thus, the total sample size of the farmers was 180. Tabular analysis and some simple statistical tools like percentage and averages were done for the interpretation of analysis of data.

RESULTS AND DATA ANALYSIS :

Table 1 reveals the general information about the Bt cotton growers. The average age of the respondents was 42.93, 46.37 and 48.33 years for small, medium and large farmers respectively, indicating that most of the farmers were of middle age group. Hence, middle age farmers have more aggressive in adopting new technology in the form of Bt cotton for more profit. The

average size of the family was around seven. This was slightly more for large farmers indicating most of the families (61.67%) were nuclear families. Majority (57.22%) of the farmers belonged to medium size family (4-6 members). This might be due to their awareness regarding the increased cost of living and difficulties in maintenance of big family and they might have found to have medium families to lead better and comfortable life. The predominance of nuclear family was due to the realization of advantages of nuclear family in terms of running family, less responsibilities, privacy and more freedom of action in taking family decisions. In all the category of farmers, male population was found high compared to female population as the average male population was high (2.33) compared to female population (2.15) in the family. Whereas the average children

population was 2.48. All the respondents were involved in agriculture. In addition to agriculture, 83.33 per cent were of them working as agricultural labourers, because of seasonality of agriculture. Remaining farmers were involved in other jobs and work outside field because of their small land holding. The similar results were observed by the studies conducted by Dodamani and Guledgudda (2010).

With respect to the literacy rate, it was noticed that majority of farmers were educated in the study area (Table 2). Literacy level of sample respondents ranged from primary to degree. It is noted fact that higher the education level more will be the knowledge and better will be the understanding capacity of new technologies. Majority of the small and medium farmers possessed education upto middle school level, whereas most of the

Table 1: Socio-economic characteristics of sample farmers

Sr. No.	Particulars	Unit	Small (n=60)	Medium (n=60)	Large (n=60)	Over all (n=180)
1.	Age of the farmer	Years	42.93	46.37	48.33	45.88
2.	Size of the family	Number	6.18	7.05	7.72	6.98
	Small size (1-3)	Number	2 (3.33)	-	-	2 (1.11)
	Medium size (4-6)	Number	38 (63.33)	36 (60.00)	29 (48.33)	103 (57.22)
	Large size (7-9)	Number	8 (13.33)	6 (10.00)	15 (25.00)	29 (16.11)
	Very large size (>9)	Number	12 (20.00)	18 (30.00)	16 (26.67)	46 (25.56)
3.	Type of family					
	nuclear	Number	36 (60.00)	32 (53.33)	43 (53.33)	111 (61.67)
	Joint	Number	24 (40.00)	28 (46.67)	17 (46.67)	69 (38.33)
4.	Family composition					
	Male	Number	2.40 (38.84)	2.12 (30.07)	2.54 (32.90)	2.33 (33.67)
	Female	Number	2.15 (34.79)	2.03 (28.79)	2.28 (29.53)	2.15 (30.80)
	children	Number	1.63 (26.37)	2.90 (41.13)	2.90 (37.57)	2.48 (35.53)
5.	Occupation					
	Agriculture +Agriculture wagers	Number	45 (75.00)	52 (86.67)	53 (88.33)	150 (83.33)
	Agriculture + other jobs	Number	15 (25.00)	8 (13.33)	7 (11.67)	30 (16.67)
6.	Experience in Bt. cotton cultivation	Years	3.94	5.21	5.64	4.93

Note: Figures in the parentheses indicate percentage to total

Table 2 : Educational status of the sample farmers

Sr.No.	Particulars	Small (n=60)	Medium (n=60)	Large (n=60)	Overall (n=180)
1.	Illiterate	17.00 (28.33)	1.00 (1.67)	13 (21.67)	31 (17.22)
2.	Literate	43.00 (71.67)	59.00 (99.33)	47 (78.33)	149 (82.78)
3.	Primary school	5.00 (11.63)	9.00 (15.25)	6 (12.77)	20 (13.42)
4.	Middle school	20.00 (46.51)	15.00 (25.42)	7 (14.89)	42 (28.19)
5.	High school	15.00 (34.88)	30.00 (20.85)	14 (29.78)	59 (39.60)
6.	Pre university	1.00 (2.33)	2.00 (3.39)	8 (17.02)	11 (7.38)
7.	Degree and above	2.00 (4.65)	3.00 (5.08)	12 (25.53)	17 (11.41)

Note: Figures in the parentheses indicate percentage to total

large farmers educated upto high school and degree level. It was noticed that on an average 71.67 per cent, 99.33 per cent and 78.33 per cent of small, medium and large sample farmers were observed to be literates. It is also apparent from the results presented in Table 2 that the education levels of the medium and large farmers were high as compared to that of small farmers because of their better financial position.

From Table 3, it revealed that average size of the land holding was 1.29 ha, 2.65 ha, and 7.77 hectares for

small, medium and large farmers, respectively and the respective leased in lands held by them was included 0.06 ha, 0.27 ha, and 0.81 hectares. Bt cotton was the most popular commercial crop in the study area as average area allocated for the Bt cotton was 0.89 ha, 1.7 ha, and 3.98 hectares for small, medium and large farmers, respectively.

As could be seen from Table 4 that all the three categories of farmers were growing a number of crops. The major crops grown during *Kharif* by sample farmers

Table 3 : Operated area under Bt cotton					(Hectares)
Sr. No.	Particular	Small (n=60)	Medium (n=60)	Large (n=60)	Overall (n=180)
1.	Average size of land	1.29	2.65	7.77	3.90
2.	Average size of leased in land	0.06	0.27	0.81	0.38
3.	Total operational land holdings	1.35	2.92	8.58	4.28
4.	Average area under Bt cotton	0.89	1.7	3.98	2.19

Table 4 : Cropping pattern of sample farmers in study area					
Sr. No.	Crops	Small (n=60)	Medium (n=60)	Large (n=60)	Overall (n=180)
I. Kharif					
1.	Bt cotton	0.89 (65.93)	1.70 (58.22)	3.98 (54.77)	2.19 (50.46)
2.	Maize	0.07 (5.19)	0.09 (3.08)	0.94 (10.57)	0.37 (8.45)
3.	Chilli + Garlic	0.15 (11.11)	0.65 (22.26)	1.31 (14.40)	0.70 (15.97)
4.	Greengram	0.0 (0.00)	0.0 (0.00)	0.16 (1.80)	0.05 (1.23)
5.	Ground nut	0.12 (8.89)	0.34 (11.64)	2.07 (23.28)	0.84 (19.43)
6.	Soybean	0.12 (8.89)	0.07 (2.40)	0.40 (4.50)	0.20 (4.53)
	Sub-total	1.35 (100)	2.92 (100)	8.58 (100)	4.29 (100)
II. Rabi					
1.	Jowar	0.19 (63.33)	0.31 (49.21)	1.57 (44.23)	0.69 (46.31)
2.	chickpea	0.03 (10.00)	0.23 (36.51)	1.25 (35.21)	0.50 (33.78)
3.	Wheat	0.08 (26.67)	0.09 (14.29)	0.73 (25.56)	0.30 (20.13)
	Sub total	0.3 (100)	0.63 (100)	3.55 (100)	1.49 (100)
III. Gross cropped area					
IV	Net cropped area	1.65	3.55	12.43	5.88
V	Cropping intensity index (%)	122.22	121.58	144.87	137.06

Note: Figures in the parentheses indicate percentage to total

Table 5 : Cost and returns profile of Bt cotton production					(Rs./ha)
Sr. No.	Particulars	Small (n=60)	Medium (n=60)	Large (n=60)	Overall (n=180)
1.	Total cost of cultivation	29217.63	30820.15	32723.90	30920.56
2.	Gross returns including by-products (Rs./ha)	98429.67	115299.30	117401.80	110376.92
3.	Net return	69212.04	84479.15	84677.9	79456.36
4.	Cost of production (Rs./qtl)	1202.372	1206.74	1303.741	1237.813
5.	Profit (Rs./qtl)	2848.232	3307.719	33736.22	3180.799
6.	B:C ratio	3.37	3.74	3.59	3.57
7.	Yield (Qtls/ha)	24.30	25.54	25.10	24.98

were Bt cotton, chilli, groundnut and maize. Among these crops, the area under Bt cotton was found to be the highest. On average area occupied by the Bt cotton was 0.89 hectares, 1.7 hectares and 3.98 hectares, respectively on small, medium and large farmers and was 2.19 ha for overall category of farmers.

Maize occupied 0.07 hectares, 0.09 hectares and 0.94 hectares on small, medium and large farmers field, respectively. The average area under chilli+ garlic (inter crop) area was 0.15 ha, 0.65 ha and 1.31 hectares for small, medium and large farmers, respectively. Farmers grew groundnut crop on 0.12 ha, 0.34 ha, and 2.07 hectares, in the case of small, medium and large farmers, respectively. The average area under soybean crop was 0.12 ha, 0.07 ha and 0.40 hectares on small, medium and large farms, respectively. During *Rabi* season jowar, chickpea and wheat were the major crops grown. The average total area under these crops was 0.3, 0.63 and 3.55 hectares, in the case of small, medium and large farmers, respectively. Among the *Rabi* crops jowar is the leading crop. The average area under jowar crop was 0.19 ha, 0.31 ha and 1.57 hectares for small, medium and large farmers, respectively. The respective area for chickpea crop was 0.03 ha, 0.23 ha, and 1.25 hectares. Area occupied by wheat crop area was 0.08 ha, 0.09 ha, and 0.73 hectares in the case of small, medium and large category of farmers, respectively. Cropping intensity was seen high in the case of large farmers *i.e.* 144.87 per cent followed by small farmers (122.22%) medium farmers (121.58) and worked out to be 137.06 per cent for the overall category of sample farms.

With respect to returns analysis from Table 5, the results revealed that among the three categories of farmers the total cost incurred by the large farmers were high (Rs. 32723.9/ha) as compared to small and medium farmers (Rs.29217.63/ha and Rs. 30820.15/ha). The gross returns obtained per hectare by large farmers were high (Rs.117401.80/ha) as compared to small and medium farmers (Rs.98429.67/ha and Rs.115299.30/ha, respectively). Net returns per hectare obtained were high in the case of large farmers (Rs. 84677.90 /ha) as compared to small and medium farmers (Rs. 69212.04/ha and Rs.84479.15/ha, respectively). However, yield

obtained by the medium farmers was the highest *i.e.* 25.54 quintals/ha as compared to small and large *i.e.* 24.30 and 25.10 quintals/ha. This might be due to better output price realized by them than by their other counterparts. The per quintal cost of production was Rs. 1237.81 and the per quintal profits realized were Rs. 3180.80, due to very high price received by respondents. Thus, cultivation of Bt cotton in the study area was found to be very profitable as also supported by a very high magnitude of B: C ratio of 3.57 for overall study area. The similar results were observed by the research conducted Dodamani *et al.* (2010) and Chandrashekhar and Mahendra (2009).

The B:C revealed that Bt cotton is a profitable commercial crop. Medium and large farmers were more educated and education level of the farmers played a crucial role in adopting the Bt cotton technology and reducing the costs on pesticides and increasing their profit. The role of public extension system need to be stressed upon for capacity building of farmers for optimum harnessing of the benefits of new generation technologies like Bt cotton.

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